

# A NIOSH Approach to a TB Outbreak

Tuberculosis in Elephants: Science, Myth and Beyond  
Kansas City, MO  
April 5-6, 2011

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# Objectives

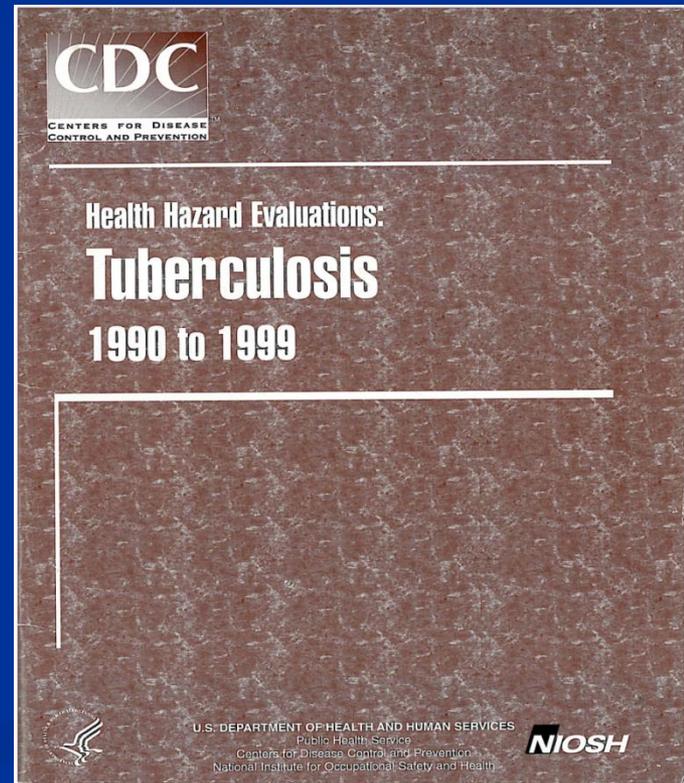
- Explain the NIOSH health hazard evaluation/technical assistance program
- Share investigation methods that can be used to evaluate risk of TB exposure
- Discuss relevance of these methods to the elephant/worker environment incorporating examples from a recent evaluation

# NIOSH Health Hazard Evaluation (HHE) Program

- NIOSH is an agency within CDC
- An HHE is a study of a workplace to determine whether workers are exposed to harmful workplace substances or physical agents
- NIOSH uses a multidisciplinary team-based approach
- Requestors contact NIOSH to initiate this free service

# NIOSH and TB

- We have conducted TB related HHEs in multiple work settings, including:
  - Health Care
  - Correctional
  - Homeless Shelters
  - Others...



# Recent NIOSH HHE

- TA request in March 2010 – Elephant Refuge
- 2 site visits in September and October 2010
- Focus on ventilation and work practices
- Provided detailed recommendations in April 2011



# *M. tuberculosis* Transmission

- Known:
  - Occurs through respiratory aerosols in shared air environments
  - Zoonotic transmission from elephants to humans is possible
  - Low risk of TB infection through surface contact in human to human transmission environments
- Unknown (as related to elephants):
  - Other transmission routes (fecal shedding?)
  - Re-aerosolization of settled *M. tuberculosis*?
  - Exposure in outdoor environments?

# Hierarchy of Controls

- Substitution/Elimination
  - Engineering
    - Dilution or local exhaust ventilation, barriers
  - Administrative
    - Work practices and policies
  - Personal Protective Equipment
    - Respiratory protection, gloves, etc...
- Most effective
- 
- Least effective

# Ventilation System (Engineering Controls)

- Dilution ventilation guidelines available (health care, corrections) (CDC 2005)

**TABLE 2. Ventilation recommendations for selected areas in new or renovated health-care settings**

Health-care setting	Minimum mechanical ACH*	Minimum outdoor ACH*	Air movement relative to adjacent areas	Air exhausted directly outdoors†
Microbiology laboratory	6	§	In	Yes
Anteroom to All <sup>¶</sup> room	10	§	In/Out	Yes
All room**††	12	2	In	Yes
Autopsy suite	12	§	In	Yes
Bronchoscopy room	12	2	In	Yes
Emergency department and radiology waiting rooms	12–15 <sup>§§</sup>	2	In	Yes
Operating room or surgical room	15 <sup>¶¶</sup>	3 <sup>§§</sup>	Out	§
	25 <sup>***</sup>	15 <sup>¶¶</sup>		
		5 <sup>***</sup>		

- Local exhaust ventilation available for some procedures

# Ventilation systems

- Evaluation Methods
  - Visualize air flow (smoke testing)
  - Flow hood (ACH)
  - Micromanometer (pressure differential)
- How does this protect the worker inside/outside the room with the infectious patient?



# Administrative Controls

- Written TB Program
  - TST Testing, training, infection control
- Written Respiratory Protection
  - OSHA Requirements (29 CFR 1910.134)
    - Medical clearance
    - Annual fit testing
    - Respirator cleaning and maintenance
    - Employee training
    - Procedures for proper use
    - Other ...

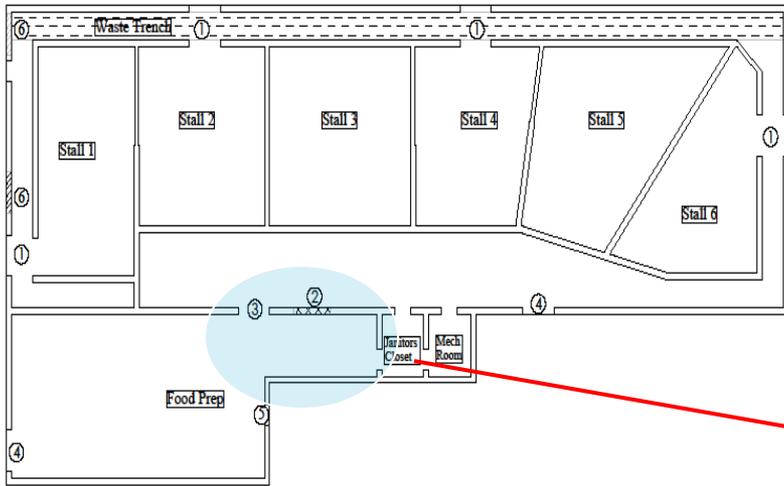
# Personal Protective Equipment

- Respiratory protection required (N95 or greater) (CDC 2005)
  - Shared air with suspected or known TB patient
  - Cough inducing or aerosol generating procedures
  - Laboratorians conducting aerosol producing procedures
- Evaluation Methods
  - Observe workers using respirators
    - Correct respirator for environment/fit testing?
    - Tight fit?
    - Facial hair?
    - Donning and doffing technique

# TB Positive Elephant Environment

## ■ Ventilation Controls

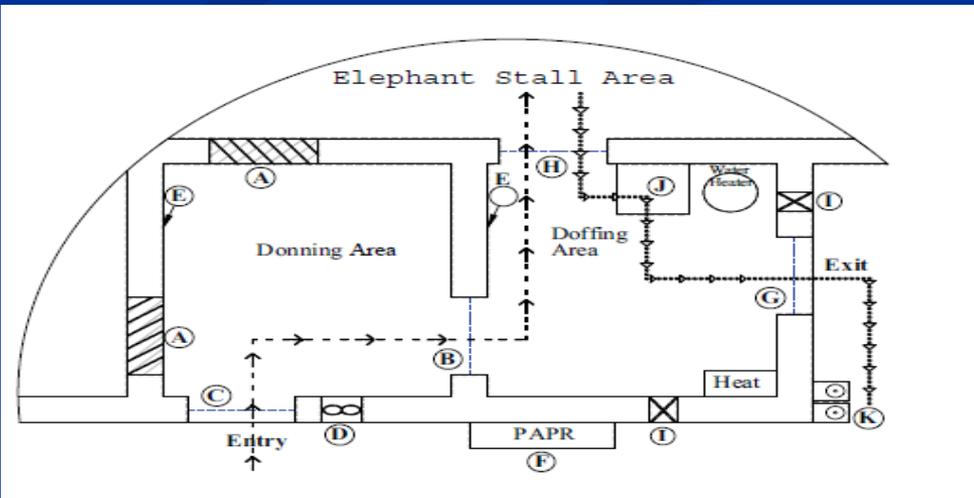
- Minimize shared air between elephant and worker
  - Seal openings between elephant housing areas and adjacent worker areas
  - Use directional airflow/ante room design
  - General ventilation (air dilution) in elephant housing area
  - Separate ventilation systems
- How would you modify your current barn if an elephant was diagnosed with active or suspected TB?



Notes

- ① - Overhead door to outside (typ. of 4).
- ② - Pass through windows
- ③ - French doors
- ④ - Double outside door
- ⑤ - Single outside door
- ⑥ - Exhaust Fan (typ. of 2)

Nick Trifonoff



# TB Positive Elephant Environment

- Administrative Controls
  - TB written program for employees
  - TB testing program for elephants (USAHA 2008)
  - Written Respiratory Protection Program (OSHA requirement)
  - Policy on aerosol generating procedures
    - Pressure washing and dry sweeping
    - Disinfection of potentially TB contaminated materials
  - Heat Stress Program?

# TB Positive Elephant Environment

## ■ PPE

- Wear a NIOSH N95 or higher respirator in shared air with elephant(s) with known or suspected TB
  - Elephant housing area
  - Keeper areas if shared air with elephant housing areas
  - Close contact with elephants in outdoor environments (within 25 feet)?
  - During aerosol generating procedures (trunk wash, high pressure washing, hay and waste cleanup, necropsy)
  - Advantages and disadvantages of different respirators (Lenhart et al. 2004)
- Wear disposable suit and gloves to reduce skin/clothing contamination



# Acknowledgements

## **NIOSH**

Ken Mead

Brad King

Nick Trifonoff

**Tennessee Department of  
Health**

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The findings and conclusions in this presentation have not been formally disseminated by the National Institute for Occupational Safety and Health and should not be construed to represent any agency determination or policy.

# References

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**QUESTIONS?**